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Attorney's Docket: 1998CH017
Serial No.: 09/744,784
Art Unit 1751

REMARKS

Claims 12-15 stand rejected under 35 USC § 102(b) as being anticipated from Mitsubishi Kasei Corporation (JP-06073320). Applicants respectfully traverse this objection. Applicants note, that Claim 12 specifically defines the composition of the current invention as an aqueous solution of at least one reactive dye. A reactive dye must contain by definition at least one substituent capable of forming a covalent bond with the fiber on which it is applied. Please find enclosed a copy of page 386 from Kirk-Othmer, "Concise Encyclopedia of Chemical Technology", which contains the definition for reactive dyes previously given. JP 06-073320 relates to a defined recording liquid containing a water soluble dye such as a direct or acid dye, neither of which forms a covalent bond with the substrate.

For the reason listed above Applicants believe that the teaching of Mitsubishi Kasei Corporation fails to make the present invention anticipated, and applicants respectfully request that claims 12-15 be allowed.

Claims 16-22 stand rejected under 35 USC § 103(a) as being obvious from Mitsubishi Kasei Corporation (JP-06073320) in view of Dainippon Ink and Chemical KK (JP 58-198570). This objection is respectfully traversed.

JP-06073320 would not have been obvious based on the argument given above for the allowance of Claims 12-15. The current invention contains at least one reactive dye. JP-06073320 is comprised of a direct dye or an acid dye.

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JP 58-198570 relates to pigment compositions. Pigments are insoluble in the media of application in this case water. Dainippon teaches the addition of a thickener for pigment dispersions produced by grinding the pigment in the presence of glass beads and defined adjuvants. The current invention is a solution as the reactive dyes are soluble in water. Any considerations about addition of a thickener of the secondary reference in the primary reference are not pertinent because of the different utility and kind of composition in the references: in JP 06-073320 a recording liquid with a water soluble direct or acid dye of the defined formula for ink jet recording; in JP 58-198570 printing compositions which are pigment dispersions produced e.g. by grinding the pigment with beads in the presence of defined adjuvants. No one of ordinary skill in the art would consider that additions made to a water insoluble pigment would be readily adaptable to water soluble dyes. There is no teaching in either reference, or any suggestion that these references can or should be combined.

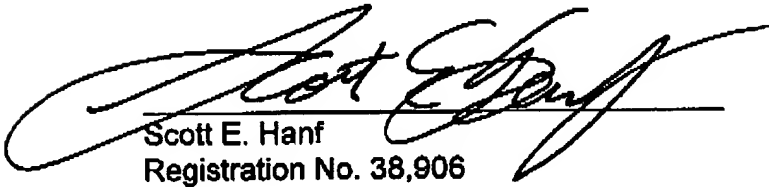
For the reasons listed above Applicants believe that the teaching of Mitsubishi Kasei Corporation and Dainippon Ink and Chemical KK fail to make the present invention obvious, and applicants respectfully request that claims 16-22 be allowed.

As the total number of claims does not exceed the number of claims originally paid for, no fee is believed due. However if an additional fee is required, the Commissioner is hereby authorized to credit any overpayment or charge any fee deficiency to Deposit Account No. 03-2060.

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Reconsideration and allowance of this application is respectfully
requested.

Respectfully submitted,



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Attachment: Pages 377 and 386 from Kirk-Othmer, "Concise Encyclopedia of
Chemical Technology" (3 pages)

KIRK-OTHMEI

CONCISE ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY

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DYES AND DYE INTERMEDIATES

Dyes are intensely colored substances used for the coloration of various substrates, including paper, leather, fur, hair, foods, drugs, cosmetics, waxes, greases, petroleum products, plastics, and textile materials. They are retained in these substrates by physical adsorption, salt or metal-complex formation, solution, mechanical retention, or by the formation of covalent chemical bonds. The methods used for the application of dyes to the substrates differ widely, depending upon the substrate and class of dye. It is by application methods, rather than by chemical constitution, that dyes are differentiated from pigments. During the application process dyes lose their crystal structures by dissolution or vaporization. The crystal structures may in some cases be regained during a later stage of the dyeing process. Pigments, on the other hand, retain their crystal or particulate form throughout the entire application procedure. They are usually applied in vehicles, such as paint or lacquer films, although in some cases the substrate itself may act as the vehicle, as in the mass coloration of polymeric materials.

The optical properties of dyes are determined by electronic transitions between the various molecular orbitals of the dye molecules that absorb some, but not all, of the incident radiation. These properties are defined by the terms color, intensity, and brightness. The color, also frequently

referred to as the shade or hue, of a dye is determined by the energy differences between the molecular orbitals. The intensity, strength, saturation is determined by the probability of the electronic transition and the amount of dye present. The brightness or purity depends upon the width of the waveband absorbed by the dye molecules (see Color).

The energy, probability, and distribution of the electronic transitions are, to a large extent, governed by the chemical constitution of the molecules. The chemical constitution also determines the other properties of a dye, such as the suitability for dyeing a specific substrate, the fastness properties of dyeings produced by the application of the dye to the substrate. A large number of dyes, with widely differing properties, is necessary because of the great variety of materials to be dyed. There are at present some 1200 different commercial dyes manufactured in the United States, and a further 800 are imported. On a worldwide basis, over 8000 chemically different dyes have achieved commercial significance. To assist both the dye users and dye manufacturers, dyes are classified into groups in two ways. The first method of classification is by chemical constitution, in which the dyes are grouped according to the chromophore or color-giving unit of the molecule. The second method is based on the application class or use of the dye. The first, from a chemical standpoint, satisfies the needs of the manufacturer, and the second is used by the dyer.

Table 1. Usage Classification of Dyes

Class	Major substrates	Method of application	Chemical types	Relevant articles in ECT
acid	nylon, wool, silk, paper, inks, and leather	usually from neutral to acidic dyebaths	azo, including premethylated dyes, anthraquinone, triphenylmethane, azine, xanthene, nitro, and nitroso	Azo dyes
azoic components and compositions	cotton, rayon, cellulose acetate, and polyester	fiber impregnated with coupling component and treated with a solution of stabilized diazonium salt	azo	Azo dyes
basic	acrylic, modified nylon and polyester, paper, and inks	applied from acidic dyebaths	methine, diphenylmethane, triaryl methane, azo, azine, xanthene, thiazole, acridine, oxazine, and anthraquinone	Azine dyes; Azo dyes
direct	cotton, rayon, paper, leather, and nylon	applied from neutral or slightly alkaline baths containing additional electrolyte	azo, phthalocyanine, stilbene, oxazine, and thiazole	Azine dyes; Azo dyes
disperse	polyester, polyamide, cellulose, acetate, acrylic, and plastics	fine, aqueous dispersions often applied by higher temperature-pressure or lower temperature carrier methods; dye may be padded on cloth and baked on or thermofixed	azo, anthraquinone, nitro, and methine	Azo dyes; Dyes, anthraquinone
fluorescent brighteners	soaps and detergents, all fibers, oils, paints, and plastics	from solution, dispersion or suspension in a mass	stilbene, azoles, coumarin, pyrazine, and naphthalimides	Brighteners, fluorescent
food, drug, and cosmetic	foods, drugs, and cosmetics		azo, anthraquinone, carotenoid, and triaryl methane	Colorants for foods, drugs, and cosmetics
mordant	wool, leather, and anodized aluminum	applied in conjunction with chelating Cr salts	azo and anthraquinone	Azo dyes; Dyes, applications and evaluation
natural		applied as mordant, vat, solvent, or direct and acid dyes	anthraquinone, polymethine, ketone imine, flavones, indigoids, quinones, chlorophylls, etc	Dyes, natural
oxidation bases	hair, fur, and cotton	aromatic amines and phenols oxidized on the substrate	aniline black and indeterminate structures	Azine dyes
pigments	paints, inks, plastics, and textiles	printing on the fiber with resin binder or dispersion in the mass	azo, basic, phthalocyanine, quinacridone, oxazine, anthraquinone, and indigoid	Pigments
reactive	cotton, rayon, wool, silk, and nylon	reactive site on dye reacts with functional group on fiber to bind dye covalently under influence of heat and proper pH	azo, anthraquinone and phthalocyanine	Dyes, reactive
solvent	gasoline, varnish, lacquer, stains, inks, fats, oils, and waxes	dissolution in the substrate	azo, triphenylmethane, anthraquinone and phthalocyanine	Azo dyes; Dyes, anthraquinone; Phthalocyanine compounds
sulfur	cotton and rayon	aromatic substrate vatting with sodium sulfide and reoxidized to insoluble sulfur containing products on the fiber	indeterminate structures	Sulfur dyes
vat	cotton, rayon, and wool	H ₂ O insoluble dyes solubilized by reducing with sodium hydrosulfite, then exhausted on fiber and reoxidized	anthraquinone (including polycyclic quinones), and indigoids	Dyes, anthraquinone

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Closely related in chemical structure to the above flavones are substituted dihydropyrans. The most important naturally occurring members are haematin and its leuco form, haematoxilin. These are the principal coloring bodies of logwood (CI Natural Black 1, CI 75290) historically one of the most important natural dyes for dark shades of silk, wool, cotton, leather, wood, and animal bristles, hair, and fur. It is still used extensively in dyeing and tanning leather.

Anthocyanidins (flavylium salts) are glycosides of hydroxylated 2-phenylbenzopyrylium salts. They are usually isolated as the chlorides after hydrolytic fission of the glycoside with hydrochloric acid. The color developed by the plant is determined by the pH of the cell sap. For example, cyanin is red under acidic conditions, violet at neutral pH, and blue under alkaline conditions.

Natural dyes, particularly red shades, have become increasingly important for use in food coloring. With the FDA's withdrawal of FD & C Reds 2 and 4, new sources for food colors have been required. The initial approach by the food-dye industry has been to return to natural dyes such as those of the anthocyanin class.

Alloxan adduct. A yellow dye currently being used as a food colorant is the phosphate salt of riboflavin, vitamin B₂ (see Vitamins). This is found in varying amounts in all plant and animal cells; particularly good natural sources are milk, eggs, malted barley, yeast, liver, kidney, and heart. Excretion of riboflavin in the urine is responsible for the yellow color. Structurally, riboflavin is an alloxan derivative.

Betanin

Another natural dye that is currently being used in food to take the place of the delisted FD & C Reds 2 and 4 is obtained from red beet extracts, *Beta vulgaris*. This is available as beet-juice concentrate, dehydrated beet root, and spray-dried extracts. Red beet root contains both red and yellow pigments of the class betaines; these are quaternary ammonium amino acids. The red bodies are betacyanine pigments of which the major constituent is betanin.

Indigoid Dyes

Two very important natural dyes have the indigoid structure. Indigo, the main product that gives this dyestuff class its name, is still one of the primary dyes of the world, although now made via a synthetic route. Tyrian or royal purple, although no longer in demand, was once the prize sought by the Caesars. The source of Tyrian purple is the purple shellfish or *Murex Brandaris* found in shallow waters throughout the Mediterranean. Each mollusk contains a few drops of glandular mucous; this fluid at first appears white, but on exposure to light changes to yellow-green and eventually violet or reddish-purple. Natural indigo is obtained from the leaf of *Indigofera tinctoria*, a leguminose, widely distributed in Asia, Africa, and America. The dye is contained only in the leaf of the plant, unlike other vegetable dyes where the coloring matter is also found in the stalk, pods, and twigs. Natural indigo also contains Indigotin (CI 75780), Indirubin (CI 75790), Indigo Brown, Indigo Gluten, and Indigo Yellow (CI 75640).

Carotenoids

Although most color in the visible spectral range is generated by conjugated aromatic ring systems, another class of dyes found in nature obtains its color owing to the presence of long, conjugated double-bond chains (see Terpenoids). These dyes are the carotenoids, the class name being derived from the orange pigment found in carrots, carotene. They are also known as lipochromes because of their solubility and occurrence in fats.

Carotene (Natural Yellow 26; Natural Brown 5; CI 75130) is widely distributed throughout the vegetable and animal kingdoms. The carotenoids have use as colorants in foods and ingested drugs. β -Carotene is permanently listed by the FDA as an FD & C approved colorant (see Colorants for foods, drugs, and cosmetics). At present it is available commercially as a 30% liquid suspension; a 24% semisolid suspension; a 10% beadlet-water dispersion, and a 3% emulsion.

Another carotenoid, extract of annatto, is also used in food coloring. Currently its main use is in dairy products such as butter, margarine,

and cheese. Annatto is obtained from the pulpy portion of the seeds of the plant *Bixa orellana*, found in India, Central America, and Brazil.

Saffron is obtained from the pistils of the *Crocus sativus*, a plant the flowers in the fall and is quite different from the common spring variety, *Crocus*. The principal chemical constituent of saffron is crocin, the digentiobiose ester of crocetin.

Chlorophyll

Unlike the other natural products discussed in this article, one might not consider chlorophyll in the same class as dyestuffs. This is probably because chlorophyll does not have affinity for the natural fibers, especially cotton and wool, which can be made into wearing apparel. However, if one overlooks this most common dye requirement, chlorophyll is indeed a dyestuff (CI Natural Green 3; CI 75810). It is used extensively for coloring soaps, resins, inks, waxes (eg, candles); because it is physiologically harmless, it is used in the coloring of edible fats and oils (eg, chewing gum, confectionery, egg white, gelatin), and for cosmetics, liniments, lotions, mouthwashes, and perfumes. In the usual sense of a dye, it is used to color leather, where it exhibits good penetrating power and is especially light-stable.

Chemically pure chlorophyll is very difficult to prepare; therefore the commercial product, like that found in nature, is a mixture along with several colored substances of the carotenoid family. The main components of the natural mixture have been designated chlorophyll a and chlorophyll b, in a ratio of approximately 3 to 1, along with yellow, orange, and red bodies. The excellent hiding power of the green chlorophylls usually mask the rest whose presence is unknown until the chlorophyll is destroyed, as in the case of autumn leaves.

RUSSELL E. FARRIS
Sandoz Colors & Chemicals

W.F. Leggett, *Ancient and Medieval Dyes*, Chemical Publishing Company, New York, 1944.

A.G. Perkin and A.E. Everest, *The Natural Organic Colouring Matter*, Longmans, Green and Co., New York, 1918.

F. Mayer, *The Chemistry of Natural Coloring Matters*, ACS Monograph No. 89, translated and revised by A.H. Cook, Reinhold Publishing Co., New York, 1943.

DYES, REACTIVE

Reactive dyes are colored compounds that contain functional group capable of forming covalent bonds with active sites in fibers such as hydroxyl groups in cellulose, amino, thiol, and hydroxyl groups in wool or amino groups in polyamides. This bond formation between the functional group and the substrate results in high wetfastness properties. These dyes differ fundamentally from other types of dyes that owe their wetfastness to physical adsorption or mechanical retention (see Dyes and dye intermediates). The principal commercial applications of reactive dyes are in the dyeing of cellulose, wool, and nylon, either individually or as components of fiber blends. They are also used in dyeing silk, hair, and leather (see Dyes, application and evaluation).

Intensive research on the reaction of soda cellulose with cyanuric chloride (1) led to a useful industrial method for the production of dyeings in which a covalent bond was formed between the dye and the fiber. This development resulted in the introduction of the first range of reactive dyes for cellulose in 1956. These dyes contained either a mono-chloro- or a dichloro-s-triazine moiety, and were marketed as the Procion H (ICI) or Procion M (ICI) ranges.

